

AD-A099 091

SAI CONSULTANTS INC MONROEVILLE PA
NATIONAL DAM INSPECTION PROGRAM, HARRIS POND DAM (NDI I.D. NUMB--ETC(U)
MAR 81 B M MIHALCIN

F/G 13/13

DACW31-81-C-0015

NL

UNCLASSIFIED

1 of 1
AD-A
1000-0



END
DATE
FILMED
6-81
DTIC

AD A099091

PENNSYLVANIA RIVER BASIN
ROARING BROOK CREEK, LEBANON COUNTY

HARRIS FUND DAM

NDI ID. NO. PA-00569
PENNDER ID. NO. 40-129

PENNSYLVANIA FISH COMMISSION

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Harris Pond Dam (VLI I.L. No. 1, PA-00569)
Pennder ID. Number 40-129

River Basin
Roaring Brook
Creek, Lebanon
County,



Department of Fish and Boat Management

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the Spillway Design Flood is based on the estimated Probable Maximum Flood (greatest reasonably possible storm runoff) for the region, or fractions thereof. The Spillway Design Flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

Breach analyses are performed, when necessary, to provide data to assess the potential for downstream damage and possible loss of life. The results are based on specific theoretical scenarios peculiar to the analysis of a particular dam and are not applicable to other related studies such as those conducted under the Federal Flood Insurance Program.

DISTRIBUTION STATEMENT A
Approved for public release
Distribution unlimited

DTIC
ELECTE
MAY 18 1981

Accession For	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
NTIS GRA&I	
DTIC TAB	
Unannounced	
Justification	
Distribution/	
Availability Codes	
Avail and/or	
Special	

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Harris Pond Dam: NDI I. D. No. PA-00569

Owner: Pennsylvania Fish Commission
State Located: Pennsylvania (PennDER I. D. No. 40-129)
County Located: Luzerne
Stream: Roaring Brook Creek
Inspection Date: 22 October 1980
Inspection Team: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, operational history, and available engineering data, the dam is considered to be in good condition.

The size classification of the facility is small and the hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. Since the facility is classified near the lower bounds of the small category, the SDF is considered to be the 1/2 PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store only about 13 percent of the PMF prior to overtopping of the embankment. Overtopping, even under floods of 1/2 PMF (SDF) magnitude, is not expected to cause failure of the structure due to its stable configuration. Thus, the spillway is considered to be inadequate, but not seriously inadequate.

It is recommended that the owner immediately:

a. Develop a formal emergency warning system to notify downstream residents should hazardous embankment conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

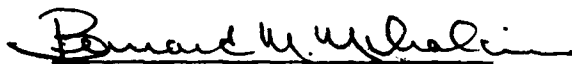
b. Repair the deteriorated concrete associated with the spillway and corewall.

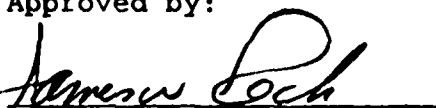
Harris Pond Dam: NDI I.D. No. PA-00569

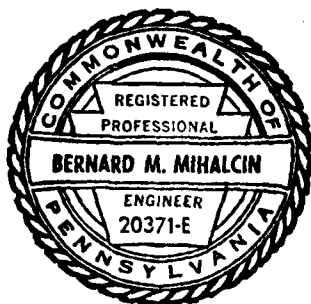
c. Develop formal manuals of operation and maintenance to ensure the future proper care of the facility.

GAI Consultants, Inc.

Approved by:


Bernard M. Mihalcin, P.E.


JAMES W. PECK
Colonel, Corps of Engineers
District Engineer



Date 27 March 1981

Date 15 APR 81



OVERVIEW PHOTOGRAPH

TABLE OF CONTENTS

	<u>Page</u>
PREFACE.	i
ABSTRACT	ii
OVERVIEW PHOTOGRAPH.	iv
TABLE OF CONTENTS.	v
SECTION 1 - GENERAL INFORMATION.	1
1.0 Authority.	1
1.1 Purpose.	1
1.2 Description of Project	1
1.3 Pertinent Data	2
SECTION 2 - ENGINEERING DATA	6
2.1 Design	6
2.2 Construction Records	7
2.3 Operational Records.	7
2.4 Other Investigations	7
2.5 Evaluation	7
SECTION 3 - VISUAL INSPECTION.	8
3.1 Observations	8
3.2 Evaluation	8
SECTION 4 - OPERATIONAL PROCEDURES	10
4.1 Normal Operating Procedure	10
4.2 Maintenance of Dam	10
4.3 Maintenance of Operating Facilities.	10
4.4 Warning System	10
4.5 Evaluation	10
SECTION 5 - HYDROLOGIC/HYDRAULIC EVALUATION.	11
5.1 Design Data.	11
5.2 Experience Data.	11
5.3 Visual Observations.	11
5.4 Method of Analysis	11
5.5 Summary of Analysis.	11
5.6 Spillway Adequacy.	12
SECTION 6 - EVALUATION OF STRUCTURAL INTEGRITY	13
6.1 Visual Observations.	13
6.2 Design and Construction Techniques	13
6.3 Past Performance	13
6.4 Seismic Stability.	13
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES.	14
7.1 Dam Assessment	14
7.2 Recommendations/Remedial Measures.	14

TABLE OF CONTENTS

APPENDIX A - VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES
APPENDIX B - ENGINEERING DATA CHECKLIST
APPENDIX C - PHOTOGRAPHS
APPENDIX D - HYDROLOGIC AND HYDRAULIC ANALYSES
APPENDIX E - FIGURES
APPENDIX F - GEOLOGY

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
HARRIS POND DAM
NDI# PA-00569, PENNDER# 40-129

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Harris Pond Dam is a combination earth, concrete and masonry structure approximately 10 feet high and 135 feet long, including spillway. The facility has an unusual configuration more resembling a canal than an impounding structure (see Photographs 1, 5, and 6). The structure basically consists of a reinforced concrete corewall constructed across the original stream channel and extended into the abutments. The spillway is a concrete-gravity type structure located near the center of the corewall. It is constructed with a two-stage, 24-foot long, rectangular shaped, overflow opening that discharges over a step-like downstream spillway face and into a trapezoidal shaped, fish catch basin and discharge channel. Drawdown capability is provided by an 18-inch diameter pipe (presumably cast iron, but not confirmed) that discharges at the base of the spillway adjacent the left sidewall. Flow through the conduit is manually controlled by an 18-inch diameter gate valve operated from the top step of the downstream spillway face to the left of the overflow.

b. Location. Harris Pond Dam is located on Roaring Brook Creek in Ross Township, Luzerne County, Pennsylvania. The facility is situated immediately upstream of Pennsylvania Route 118, less than two miles north of the community of Sweet Valley, Pennsylvania. The dam, reservoir and watershed are contained within the Sweet Valley, Pennsylvania, 7.5 minute U.S.G.S. topographic quadrangle (see Figure 1, Appendix E). The coordinates of the dam are N41°17.6' and W76°8.0'.

c. Size Classification. Small (10 feet high, 236 acre-feet storage capacity at top of dam).

- d. Hazard Classification. High (see Section 3.1.e).
- e. Ownership. Pennsylvania Fish Commission
P. O. Box 1673
Harrisburg, Pennsylvania 17120
- f. Purpose. Recreation.
- g. Historical Data. Harris Pond Dam was constructed around 1922 by Richard A. Harris, a pharmacist from Plymouth, Pennsylvania. The structure was designed by T. H. Henderson of Wilkes-Barre, Pennsylvania and is situated at the site of an old stone masonry and earthfill structure which impounded a lake formerly known as Wolf Mill Pond.

Little information is available concerning the history and performance of this facility. The Pennsylvania Fish Commission acquired the facility in October 1966. Correspondence contained in PennDER files indicates that the facility was owned for many years by the Baptist Youth Association of Shickshinny, Pennsylvania.

No significant modifications have apparently been made to the facility since its completion.

1.3 Pertinent Data.

- a. Drainage Area (square miles). 0.5
- b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduit - Discharge curves are not available.

Discharge Capacity of Spillway at Maximum Pool = 70 cfs (see Appendix D, Sheet 11).

- c. Elevations (feet above mean sea level). The following elevations were obtained from available drawings and through field measurements based on the elevation of normal pool at 1279.0 feet as indicated in Figure 1, Appendix E.

Top of Dam	1280.5 (design). 1280.9 (field).
Maximum Pool of Records	Not known.
Maximum Pool of Record	1281 (estimate; overtopped by 1 to 2 inches in June 1972).
Normal Pool	1279.0 (assumed datum).
Service Spillway Crest	1279.0
Emergency Spillway Crest	1280.4
Top of Flashboards	1280.4
Upstream Inlet Invert	Not known.

Downstream Outlet Invert	1271.5 (design).
	1271.2 (field).
Streambed at Dam Centerline	Unknown.

d. Reservoir Length (feet).

Top of Dam	2000
Normal Pool	1950

e. Storage (acre-feet).

Top of Dam	236
Normal Pool	153

f. Reservoir Surface (acres).

Top of Dam	46
Normal Pool	39

g. Dam.

Type	Earth, concrete and masonry.
------	------------------------------

Length	111 feet (excluding spillway).
--------	--------------------------------

Height	10 feet (field measured; embankment crest to base of spillway).
--------	---

Top Width	Concrete corewall width varies from 3.5 to 4 feet. Dam is filled with earth between corewall and downstream road and it can be argued that the effective width of the structure is the distance from the corewall to the downstream edge of the road or about 75 feet (see Photograph 1).
-----------	---

Upstream Slope	1H:6V. Note: This slope corresponds to the battered dimension of the upstream face of the corewall, only two feet of which is exposed. The remainder of the wall is faced with fill or natural ground on a very gentle slope (see Photographs 3 and 4).
----------------	---

Downstream Slope	Very gentle slope exists between top of corewall and downstream road. Approximately 20H:1V.
Zoning	None. Homogeneous compacted fill was reportedly placed behind the fish catch basin walls between the concrete corewall and downstream road.
Impervious Core	Reinforced concrete corewall set on a reinforced concrete footing as indicated in Figure 3. Foundation material not known.
Cutoff	None indicated.
Grout Curtain	None indicated.
h. <u>Diversion Canal and Regulating Tunnels.</u>	None.
i. <u>Spillway.</u>	
Type	Concrete-gravity type structure with a small, rectangular shaped, overflow opening.
Crest Elevations	1279.0 feet (service). 1280.4 feet (emergency).
Crest Lengths	8 feet (service). 16 feet (emergency).
Flashboards	Wooden flashboards observed in-place across service portion of spillway crest on day of inspection (see Photographs 3 and 6).
j. <u>Outlet Conduit.</u>	
Type	18-inch diameter pipe of unknown composition.
Length	Not known.
Closure and Regulating Facilities	Flow through the outlet conduit is controlled by a

manually operated 18-inch
diameter gate valve.

Access

The control mechanism is
accessible by foot from the
embankment crest.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No formal design reports or calculations are available concerning any aspect of this facility. PennDER files contain several drawings of the facility, the most significant of which have been included in Appendix E (see Figures 2 and 3). These files also contain correspondence dating back to 1922. A construction permit application report, issued by the state and dated August 1, 1922, contains some descriptive design information.

b. Design Features.

1. Embankment. Design features of the facility are indicated in Figure 3. The dam consists primarily of a reinforced concrete corewall, 3.5 to 4 feet wide at the top and 135 feet long, placed on a reinforced concrete footing. (Note: dimensions indicated in Figure 3 do not necessarily correspond to those measured in the field.) No information is available as to the type of material upon which the footing is founded. At the center of the corewall, overflow notches were formed to provide spillway capacity. A step-like concrete-gravity section, not shown in Figure 3 (see Photograph 5), was apparently constructed to provide additional stability to the overflow portions of the corewall. The spillway discharges into a trapezoidal shaped, concrete and masonry channel that extends to the bridge located about 75 feet downstream of the corewall. Compacted earth fill was placed behind the discharge channel sidewalls between the corewall and downstream road. The upstream face of the corewall is also earth supported; however, the drawings do not specifically indicate what portions, if any, consist of fill.

2. Appurtenant Structures.

a) Spillway. The spillway is a concrete-gravity type overflow structure with a two-stage, rectangular shaped, overflow opening. The opening is located along the centerline of the corewall and is split into two levels which constitute the two stages. The upper or emergency stage has a total crest length of 16 feet and is located 0.5 feet below the top of the corewall. The lower or service stage is located 1.9 feet below the top the corewall and has a crest length of eight feet (see Photograph 3). The spillway discharges into a trapezoidal shaped, concrete and masonry channel that can be partially gated at its downstream end in order to serve as a fish catch basin (see Figure 3 and Photographs 6, 7, and 8). Flows are then directed through the arched culvert beneath the downstream roadway bridge and into a small, rectangular shaped, masonry channel which ultimately carries discharges back into the natural stream (see Photographs 11 and 12).

b) Outlet Conduit. As indicated in Figure 3, the outlet conduit consists of an 18-inch diameter pipe of unknown composition that discharges at the base of the left side of the spillway. Flows through the conduit are controlled by a manually operated 18-inch diameter gate valve located near its discharge end (see Photographs 9 and 10).

c. Specific Design Data and Criteria. No specific design data or information relative to design procedures are available.

2.2 Construction Records.

No construction records are available for the facility.

2.3 Operational Records.

No records of the day-to-day operation of the facility are maintained.

2.4 Other Investigations.

No records of other formal investigations of this facility are available with the exception of a one page state inspection report contained in PennDER files dated May 20, 1964. The condition of the facility as recorded in this report was fair.

2.5 Evaluation.

The available data are considered sufficient to make a reasonable Phase I evaluation of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the facility suggests the dam and its appurtenances are in good condition.

b. Embankment. Observations made during the visual inspection indicate the embankment is in good condition. No evidence of seepage, sloughing, erosion, animal burrows, or signs of maintenance neglect were observed. Some concrete deterioration in the forms of cracking, spalling and scaling is evident along the exposed portions of the concrete corewall (see Photographs 3 and 4). The grass covered slopes are neatly groomed and present a well maintained appearance.

c. Appurtenant Structures.

1. Spillway. Visual observations indicate the spillway is in good condition. Minor concrete deterioration, consistent with that encountered on the exposed portions of the concrete corewall, was observed associated with the spillway and fish catch basin (see Photographs 5 and 7). On the day of the inspection, non-collapsible wooden flashboards were observed in-place across the service portion of the spillway (see Photograph 6).

2. Outlet Conduit. The outlet conduit was operated in the presence of the inspection team and observed to be fully functional (see Photographs 9 and 10). The conduit is completely buried within the concrete-gravity spillway and, thus, its internal condition could not be ascertained.

d. Reservoir Area. The general area surrounding the reservoir is composed of moderate to steep slopes that are heavily forested to the north and east and grass covered to the west. No signs of slope distress were observed.

e. Downstream Channel. Discharges from Harris Pond Dam flow into a steep and broad, partially wooded valley with steep confining slopes. Approximately 8,800 feet downstream, a single dwelling is located sufficiently near the stream to possibly be affected by the floodwaters resulting from an embankment breach. It is estimated that two to five persons may inhabit this structure and, as a result, the hazard classification is considered to be high.

3.2 Evaluation.

The overall appearance of the facility suggests it to be in good condition. The only deficiency noted by the inspection team

that requires immediate remedial attention was the areas exhibiting concrete deterioration. Flashboards (reportedly removed during significant storms) were observed in-place across the service spillway. Although generally considered undesirable, they appear, in this particular case, to be of little significance relative to the safe operation of Harris Pond Dam.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

Harris Pond Dam is essentially a self-regulating facility. Wooden flashboards were observed in-place across the service portion of the spillway on the day of the inspection. Reportedly, the flashboards are removed, during periods of high flow, at the discretion of the officer-in-charge at the nearby Pennsylvania Fish Commission office. Typically, the outlet conduit is closed, but, is reportedly opened periodically to insure its operability. No formal operations manual is available.

4.2 Maintenance of Dam.

The facility is currently maintained on an informal, unscheduled basis by Pennsylvania Fish Commission personnel. No formal maintenance manual is available.

4.3 Maintenance of Operating Facilities.

The outlet conduit was operated in the presence of the inspection team and found to be functional. It is reportedly opened periodically, but not on a regular basis nor is it included in any schedule of regular routine maintenance.

4.4 Warning System

No formal warning system is presently in effect.

4.5 Evaluation.

The general appearance of the facility suggests it is well maintained. No formal program of regular routine maintenance has been established; however, formal manuals of operations and maintenance are recommended to ensure continued proper care of the facility. Incorporated into these manuals should be a formal warning system for the notification of downstream inhabitants in the event that hazardous embankment conditions develop. The system should include provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

SECTION 5

HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No formal design reports, calculations, or miscellaneous design data are available for the facility.

5.2 Experience Data.

Daily records of reservoir levels and/or spillway discharges are not available. The owner's representative reported that the dam had been overtopped by one to two inches of flow for about eight hours during the flood of June 1972. No other incidents of overtopping were recollected.

5.3 Visual Observations.

On the date of the inspection, no conditions were observed that would indicate the spillway could not function satisfactorily during a flood event, within the limits of its design capacity. The inspection team did observe that wooden flashboards were in-placed across the service spillway overflow opening, thereby, reducing the spillway capacity. These flashboards are reportedly removed during significant storms.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U.S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Harris Pond Dam ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (small) and the potential hazard of dam failure to downstream developments (high). Since the facility is classified near the lower bounds of the small category, the SDF for the facility is considered to be the 1/2 PMF.

b. Results of Analysis. Harris Pond Dam was evaluated under normal operating conditions. That is, the reservoir was initially at its normal pool or spillway elevation of 1279.0 with the spillway weir discharging freely (flashboards removed). The outlet conduit was assumed to be nonfunctional for the purpose of analysis, since the flow capacity of the conduit is not such that it would significantly increase the total discharge capabilities of the dam and reservoir. The spillway consists of a concrete-gravity type structure with discharges regulated by a two-stage, broad-crested weir. All pertinent engineering calculations relative to the evaluation of Harris Pond Dam are provided in Appendix D.

Overtopping analysis (using the modified HEC-1 computer program) indicated that the discharge/storage capacity of Harris Pond Dam can accommodate only about 13 percent of the PMF prior to embankment overtopping. The peak inflow resulting from the 1/2 PMF (SDF) event of approximately 730 cfs was somewhat attenuated by the discharge/storage capabilities of the dam and reservoir, such that the resulting 1/2 PMF peak outflow was about 560 cfs. Under 1/2 PMF conditions, the embankment was overtopped for about nine hours, by depths up to 1.0 foot above the top of the dam (Appendix D, Summary Input/Output Sheets, Sheet C). Overtopping, however, under the SDF is not expected to result in embankment failure, due to the stable configuration of the facility.

5.6 Spillway Adequacy.

As presented previously, Harris Pond Dam can accommodate only about 13 percent of the PMF prior to embankment overtopping. Though the facility cannot accommodate a flood of at least 1/2 PMF (SDF) magnitude without overtopping, the possible downstream consequences of embankment failure were not evaluated, since it was concluded that the dam was not likely to fail as a result of overtopping (in accordance with Corps directive ETL-1110-2-234). Thus, as Harris Pond Dam cannot accommodate a flood of 1/2 PMF magnitude, its spillway is considered to be inadequate, but not seriously inadequate.

SECTION 6

EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment is considered to be in good condition. The facility appears to have been adequately constructed and is well maintained. The concrete deterioration observed along the exposed portions of the corewall was the only deficiency noted by the inspection team. The condition is not considered to be significant at this time in that it does not appear to threaten the structural integrity of the wall. Nevertheless, remedial measures are recommended to prevent further deterioration.

b. Appurtenant Structures.

1. Spillway. The spillway is considered to be in good structural condition. Minor concrete deterioration, consistent with that encountered on the exposed portions of the corewall, should be repaired as in the case of the corewall, to prevent further deterioration.

2. Outlet Conduit. The outlet conduit is functional and currently considered to be in good condition. No deficiencies were noted.

6.2 Design and Construction Techniques.

No information is available that details the methods of design and/or construction.

6.3 Past Performance.

No records relative to the performance history of this facility are available. However, the owner's representative did state that the facility had overtopped for an approximate eight hour period by one to two inches of flow in June 1972. No significant damage to the dam reportedly resulted from this incident.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 1 and may be subject to minor earthquake induced dynamic forces. It is believed that the facility, as constructed, can withstand the expected dynamic forces, however, no calculations and/or investigations were performed to confirm this belief.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The results of this investigation indicate the facility is in good condition.

The size classification of the facility is small and the hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. Since the facility is classified near the lower bounds of the small category, the SDF is considered to be the 1/2 PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store only about 13 percent of the PMF prior to overtopping of the embankment. Overtopping, even under floods of 1/2 PMF (SDF) magnitude, is not expected to cause failure of the structure due to its stable configuration. Thus, the spillway is considered to be inadequate, but not seriously inadequate.

b. Adequacy of Information. The available data are considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. The recommendations listed below should be implemented immediately.

d. Necessity for Additional Investigations. No additional investigations are deemed necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner immediately:

a. Develop a formal emergency warning system to notify downstream residents in the event hazardous embankment conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

b. Repair the deteriorated concrete associated with the spillway and corewall.

c. Develop formal manuals of operation and maintenance to ensure the future proper care of the facility.

APPENDIX A
VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES

CHECK LIST VISUAL INSPECTION PHASE 1

NAME OF DAM Harris Pond Dam **STATE** Pennsylvania **COUNTY** Luzerne
NDI # PA 00569 **PENNDER #** 40-129
TYPE OF DAM Earth and Concrete **SIZE** Small **HAZARD CATEGORY** High
DATE(S) INSPECTION 22 October 1980 **WEATHER** Partly cloudy **TEMPERATURE** 40° **@** Noon
POOL ELEVATION AT TIME OF INSPECTION 1277.7 Feet **M.S.L.**
TAILWATER AT TIME OF INSPECTION N/A **M.S.L.**

INSPECTION PERSONNEL

B. M. Mihalcin

D. J. Spaeder

D. L. Bonk

OWNER REPRESENTATIVES

Pennsylvania Fish Commission

Clair Fleegeer - Regional Supervisor

OTHERS

RECORDED BY B. M. Mihalcin

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	ND# PA. 00569
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good. Vertical - good (see "Profile of Dam Crest From Field Survey," Appendix A).	
RIPRAP FAILURES	No riprap.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.	

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 00569
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None observed.	
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	None.	
DRAINS	None observed.	
MISCELLANEOUS	Embankment was apparently constructed atop the outlet of a natural lake. Plan and cross section of this structure are atypical and its limits are difficult to discern. Based strictly on appearances, failure from overtopping appears unlikely.	

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 00569
INTAKE STRUCTURE	Submerged, not observed.	
OUTLET CONDUIT (CRACKING AND SPALLING OF CON- CRETE SURFACES)	18-inch diameter conduit located beneath the concrete spillway section. Visible only at its discharge end.	
OUTLET STRUCTURE	Discharges at the base of the spillway adjacent the left sidewall of the fish catch basin.	
OUTLET CHANNEL	Trapezoidal shaped, concrete and masonry channel located between the spillway and downstream roadway. Good condition with some minor concrete deterioration evident. Channel outlet can be partially closed whereby the channel becomes a fish catch basin.	
GATE(S) AND OPERA- TIONAL EQUIPMENT	Manually controlled 18-inch diameter gate valve located near the discharge end of the conduit. Valve is operated from atop the spillway to the left of the overflow. Operated satisfactorily in the presence of the inspection team.	

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA. 00569
TYPE AND CONDITION	Concrete-gravity type structure with a small, two-stage, rectangular shaped, overflow opening. Concrete in good condition with some minor deterioration evident. Flashboards in place across service spillway opening on the day of inspection.	
APPROACH CHANNEL	Cut stone lined approach, unobstructed.	
SPILLWAY CHANNEL AND SIDEWALLS	Trapezoidal shaped, concrete and masonry fish catch basin. Concrete channel in good condition. Minor scaling, cracking, and spalling were observed. Concrete and rubble sidewalls in good condition. Minor surficial deterioration observed.	
STILLING BASIN PLUNGE POOL	See above. Fish catch basin extends from spillway overflow to roadway approximately 75 feet downstream.	
DISCHARGE CHANNEL	Beyond the fish catch basin, flow is directed through an arched, masonry culvert beneath the roadway and into a rectangular shaped, masonry channel.	
BRIDGE AND PIERS EMERGENCY GATES	Highway bridge located about 75 feet downstream of spillway weir.	

SERVICE SPILLWAY

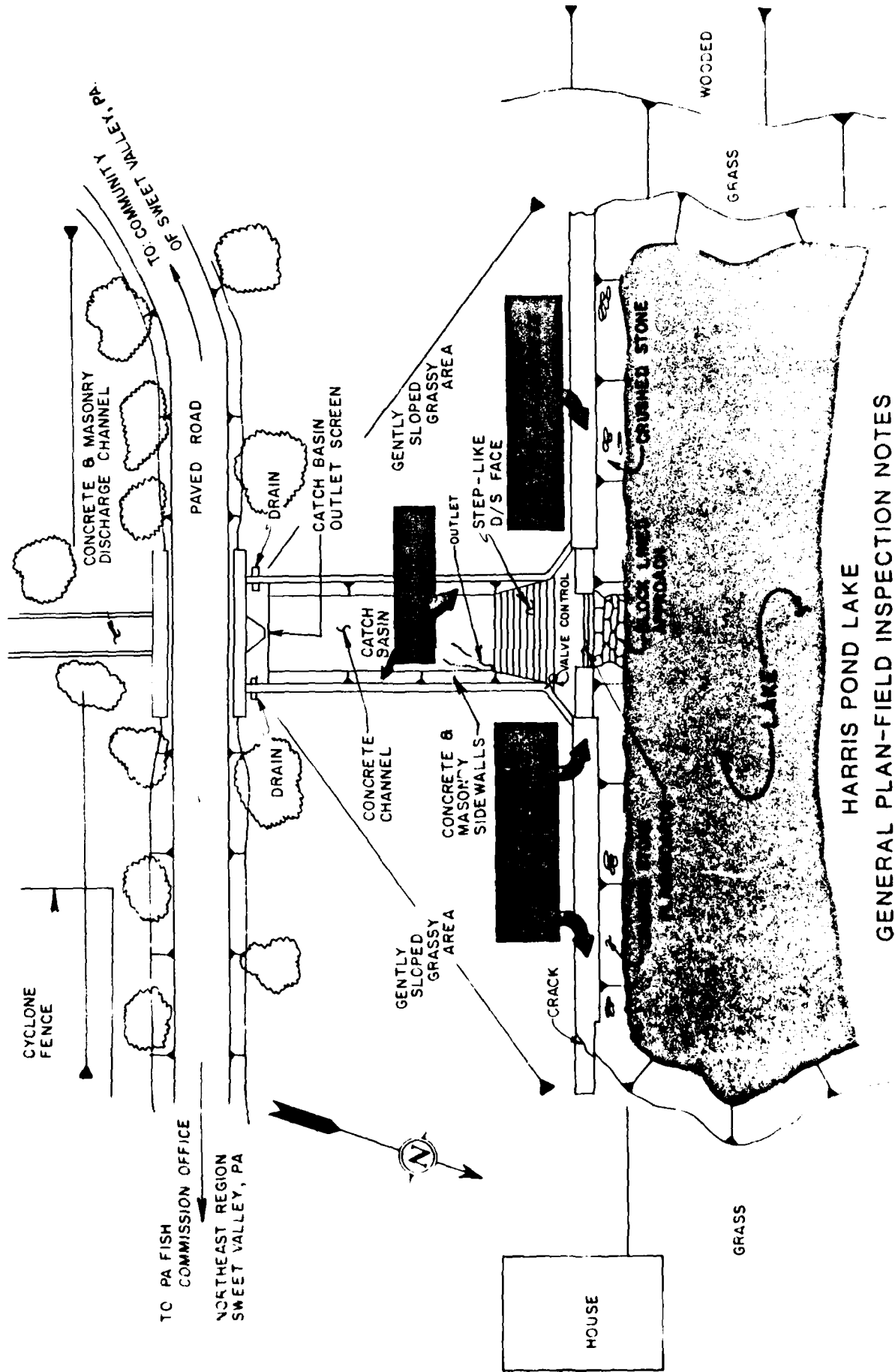
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 00569
TYPE AND CONDITION	Lower stage of a combined two-stage spillway. See "Emergency Spillway", Page 5 of 8.	
APPROACH CHANNEL	N/A.	
OUTLET STRUCTURE	N/A.	
DISCHARGE CHANNEL	N/A.	

INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 00569
MONUMENTATION SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHERS	None.	

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDIN PA - 00569
SLOPES: RESERVOIR	Moderate to steep and heavily forested.	
SEDIMENTATION	None observed.	
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Arched, masonry culvert located about 75 feet downstream of spillway crest.	
SLOPES: CHANNEL VALLEY	Discharges from Harris Pond Dam flow into a steep and broad, partially wooded valley with steep confining slopes.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Approximately 8,800 feet downstream of the dam, a single dwelling, housing two to five persons, is located sufficiently near the stream to possibly be affected by the floodwaters resulting from an embankment breach.	



HARRIS POND LAKE
GENERAL PLAN-FIELD INSPECTION NOTES

HARRIS POND DAM

PROFILE OF DAM CREST

FROM FIELD SURVEY



SUBJECT: HARRIS POND DAM
BY: DATE: 3/10/67 SHEET NO. 1
CHKD BY: DATE: 3/10/67 PROJECT NO. W-2028-157

APPENDIX B
ENGINEERING DATA CHECKLIST

**CHECK LIST
ENGINEERING DATA
PHASE I**

NAME OF DAM Harris Pond Dam

ITEM	REMARKS	NDIN PA - 00569
PERSONS INTERVIEWED AND TITLE	Pennsylvania Fish Commission Clair Fleegeer - Regional Supervisor	
REGIONAL VICINITY MAP	See Figure 1, Appendix E.	
CONSTRUCTION HISTORY	Built in 1922 by Richard A. Harris, a pharmacist from Plymouth, Pennsylvania, on site of a smaller natural lake known as Wolf Mill Pond. Acquired by Pennsylvania Fish Commission in October 1966. See Section 1.2.g.	
AVAILABLE DRAWINGS	File available from the PennDER. See Figures 2 and 3, Appendix E.	
TYPICAL DAM SECTIONS	See Figure 3, Appendix E.	
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figure 3, Appendix E. Discharge rating curves are not available.	

**CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)**

ITEM	REMARKS	NDIN PA. 00569
SPILLWAY: PLAN SECTION DETAILS	See Figure 3, Appendix E.	
OPERATING EQUIP- MENT PLANS AND DETAILS	None available.	
DESIGN REPORTS	None available.	
GEOLOGY REPORTS	None available.	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	None available.	

**CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)**

ITEM	REMARKS	NDI# PA - 00569
BORROW SOURCES	Not known.	
POST CONSTRUCTION DAM SURVEYS	No professional surveys available. Penn State students at Worthington, Pennsylvania branch campus have used the site for many years as a survey study area. Thus, unofficial survey information is probably available.	
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No professional reports or studies are available. Penn State professor Dr. Charles Rief has reportedly used his Worthington campus students to map the entire facility, including the lake bottom.	
HIGH POOL RECORDS	Overtopped in June 1972 by one to two inches for about eight hours. Flashboards were removed and the blowoff was opened. No significant damage was reportedly incurred at the dam.	
MONITORING SYSTEMS	None.	
MODIFICATIONS	Concrete surfaces were refaced about ten years ago.	

**CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)**

ITEM	REMARKS	NDI# PA - 00569
PRIOR ACCIDENTS OR FAILURES	None.	
MAINTENANCE: RECORDS MANUAL	No formal records or manuals are available.	
OPERATION: RECORDS MANUAL	No formal records or manuals are available.	
OPERATIONAL PROCEDURES	Self-regulating. Low flow is augmented by opening the blowoff several times each year during dry periods.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	None.	
MISCELLANEOUS		

GAI CONSULTANTS, INC.

**CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA**

NDI ID # PA-00569
PENNDER ID # 40-129

SIZE OF DRAINAGE AREA: 0.5 square miles.
ELEVATION TOP NORMAL POOL: 1279.0 STORAGE CAPACITY: 153 acre-feet.
ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -
ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -
ELEVATION TOP DAM: 1280.9 STORAGE CAPACITY: 236 acre-feet.

SPILLWAY DATA

CREST ELEVATION: 1279.0 feet (service); 1280.4 (emergency).
TYPE: Rectangular shaped concrete gravity type structure.
CREST LENGTH: 8 feet (service); 24 feet (overall).
CHANNEL LENGTH: Approximately 75 feet.
SPILLOVER LOCATION: Near embankment center.
NUMBER AND TYPE OF GATES: No operable gates. Non-collapsible flashboards
span service spillway overflow.

OUTLET WORKS

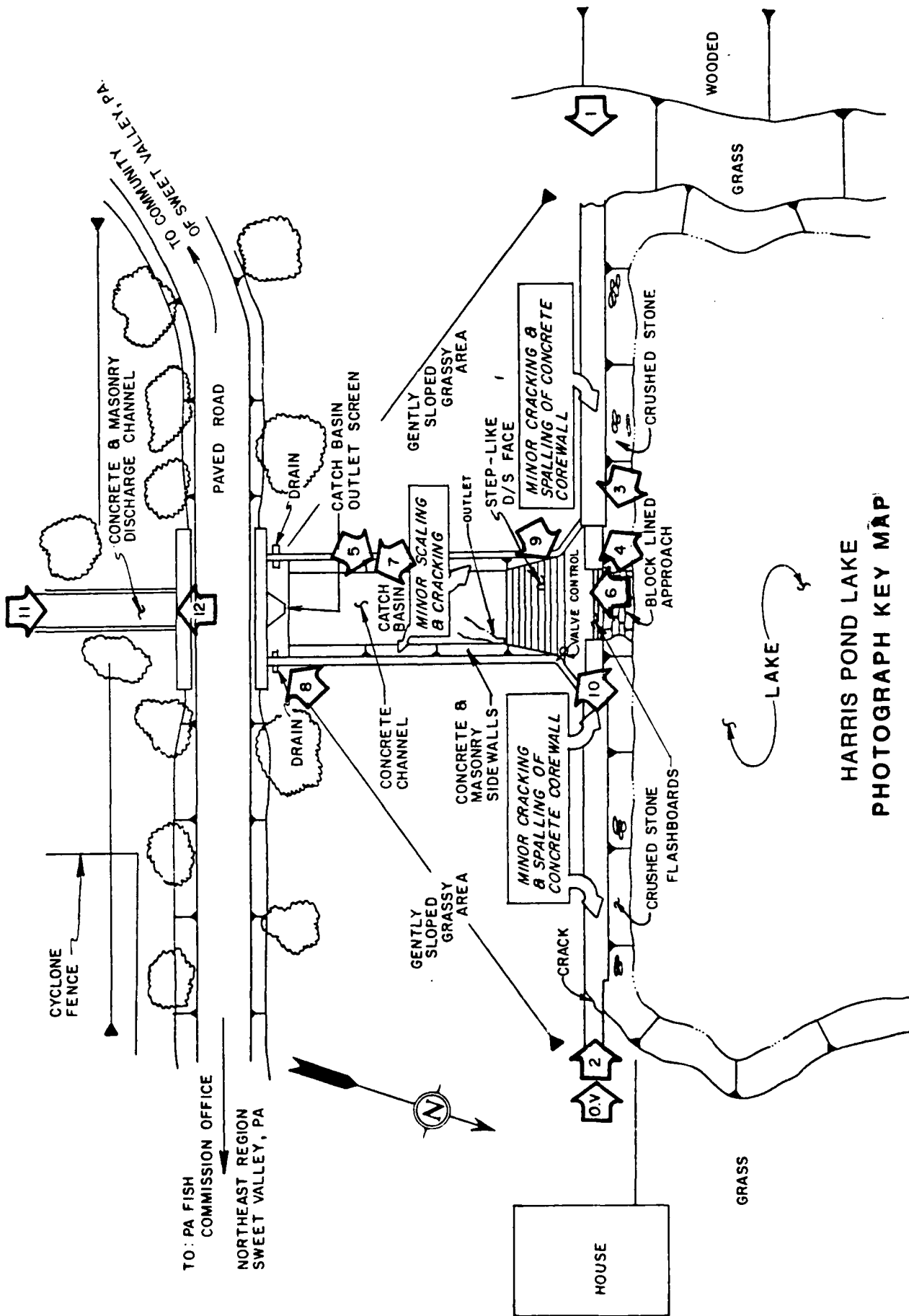
TYPE: 18-inch diameter pipe of undetermined composition.
LOCATION: Left side base of spillway.
ENTRANCE INVERTS: Not known.
EXIT INVERTS: 1271.5 feet (design); 1271.2 (field).
EMERGENCY DRAWDOWN FACILITIES: Manually operated 18-inch diameter
gate valve.

HYDROMETEOROLOGICAL GAGES

TYPE: None.
LOCATION: -
RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: Overtopped by 1 to 2 inches for 8
hours in June 1972.

APPENDIX C
PHOTOGRAPHS



HARRIS POND LAKE
PHOTOGRAPH KEY MAP

PHOTOGRAPH 1 Overview of the facility as seen from the right abutment.

PHOTOGRAPH 2 View of the top of the concrete corewall looking toward the right abutment.

PHOTOGRAPH 3 View of the upstream face of the concrete corewall looking toward the left abutment. Note the cut stone lined approach area that leads to the over-flow channel.

PHOTOGRAPH 4 View of the upstream face of the concrete corewall looking toward the right abutment.



2



4



1



3

PHOTOGRAPH 5 View, looking upstream, of the step-like downstream face of the concrete-gravity spillway section.

PHOTOGRAPH 6 Close-up view of the flashboards set across the service spillway overflow opening and the trapezoidal shaped, fish catch basin located immediately beyond.

PHOTOGRAPH 7 View of the downstream section of the fish catch basin and adjacent roadway culvert.

PHOTOGRAPH 8 Close-up view of the fish catch basin outlet structure.



6



8



5



7

PHOTOGRAPH 9 View, looking toward the left abutment, of the manual operator for the outlet conduit gate valve and its position relative to the overflow channel.

PHOTOGRAPH 10 Close-up view of the gate valve stem.

PHOTOGRAPH 11 View, looking upstream, of the arched culvert beneath the roadway downstream of the embankment.

PHOTOGRAPH 12 View of the rectangular shaped, masonry lined discharge channel downstream of the roadway.



10



12



9



APPENDIX D
HYDROLOGIC AND HYDRAULIC ANALYSES

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

- a. Development of an inflow hydrograph(s) to the reservoir.
- b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of occurrence the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

- a. Development of an inflow hydrograph(s) to the reservoir.
- b. Routing of the inflow hydrograph(s) through the reservoir.
- c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.
- d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevation(s) of failure hydrograph(s) for each location.

HYDROLOGY AND HYDRAULIC ANALYSIS DATA BASE

NAME OF DAM: HARRIS POND DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 INCHES/24 HOURS (1)

STATION	1	2	3
STATION DESCRIPTION	HARRIS POND DAM		
DRAINAGE AREA (SQUARE MILES)	0.5		
CUMULATIVE DRAINAGE AREA (SQUARE MILES)	-		
ADJUSTMENT OF PMP FOR DRAINAGE AREA LOCATION (%) (1)	VALUES SHOWN ADJUSTED BY 98%		
6 HOURS	115		
12 HOURS	124		
24 HOURS	133		
48 HOURS	140		
72 HOURS	142		
SNYDER HYDROGRAPH PARAMETERS			
ZONE (2)	13		
C_p (3)	0.50		
C_t (3)	1.85		
L' (MILES) (4)	0.5		
$t_p = C_t (L')^{0.6}$ (HOURS)	1.22		
SPILLWAY DATA (5)			
CREST LENGTH (FEET)	8/16		
FREEBOARD (FEET)	1.9/0.5		

(1) HYDROMETEOROLOGICAL REPORT 40, U.S. WEATHER BUREAU, 1965.

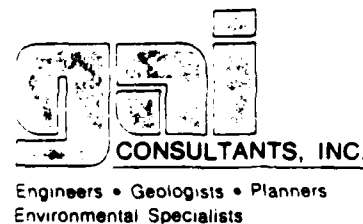
(2) HYDROLOGIC ZONE DEFINED BY CORPS OF ENGINEERS, BALTIMORE DISTRICT, FOR DETERMINATION OF SNYDER COEFFICIENTS (C_p AND C_t).

(3) SNYDER COEFFICIENTS

(4) L' = LENGTH OF LONGEST WATERCOURSE FROM RESERVOIR INLET TO BASIN DIVIDE.

(5) SERVICE/EMERGENCY

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
BY ROS DATE 2-5-81 PROJ. NO. 80-278-569
CHKD. BY DLG DATE 3-4-81 SHEET NO. 1 OF 11



DAM STATISTICS

HEIGHT OF DAM = 10 FT (FIELD MEASURED: TOP OF DAM
TO OUTLET INVERT.)

NORMAL POOL STORAGE CAPACITY = 50×10^6 GALLONS
= 153 ACRE-Feet (SEE NOTE 1)

MAXIMUM POOL STORAGE CAPACITY = 236 AC-FT (HEC-1)
(@ TOP OF DAM)

DRAINAGE AREA = 0.5 SQUARE MILES (PLANIMETERED ON USGS TOPO
QUAD - SWEET VALLEY, PA)

ELEVATIONS:

TOP OF DAM (DESIGN)	=	1280.5	(FIG. 3; SEE NOTE 2)
TOP OF DAM (FIELD)	=	1280.9	
NORMAL POOL	=	1279.0	(SEE NOTE 2)
CREST OF SERVICE SPILLWAY	=	1279.0	(FIELD SURVEY)
CREST OF EMERGENCY SPILLWAY	=	1280.4	(FIELD SURVEY)
UPSTREAM INLET INVERT (DESIGN)	=	UNKNOWN	
DOWNSTREAM OUTLET INVERT (DESIGN)	=	1271.5	(FIG. 3; SEE NOTE 2)
DOWNSTREAM OUTLET INVERT (FIELD)	=	1271.2	
STREAMBED @ DAM CENTERLINE	=	UNKNOWN	

NOTE 1: OBTAINED FROM "REPORT UPON THE APPLICATION OF RICHARD A. HARRIS,
FOR THE CONSTRUCTION OF A DAM ACROSS THE OUTLET OF WOLF MILL ROAD," ROSS
TOWNSHIP, LEBANON COUNTY, PA, JUNE 1922; FOUND IN PENN DER FILES.

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
BY DJS DATE 2-5-81 PROJ NO 80-238-569
CHKD BY DLA DATE 3-4-81 SHEET NO 2 OF 11

CONSULTANTS INC.
Engineers • Geologists • Planners
Environmental Specialists

NOTE 2: FROM THE USGS TOPO QUAD FOR SWEET VALLEY, PA,
THE NORMAL POOL IS INDICATED TO BE AT ELEVATION 1279.0,
WHICH IS THE ASSUMED ELEVATION OF THE SERVICE SPILLWAY CREST.
THIS CORRESPONDS TO THE "HIGH WATER LINE" ON FIGURES 2 AND 3.
(THE ELEVATION OF THE "HIGH WATER LINE" INDICATED TO BE AT
1290.0 ON FIGURE 2, IS APPARENTLY IN ERROR.) IT IS NOTED
THAT ALL ELEVATIONS USED IN THIS ANALYSIS ARE CONSIDERED
ESTIMATES, AND ARE NOT NECESSARILY ACCURATE.

DAM CLASSIFICATION

DAM SIZE: SMALL (REF 1, TABLE 1)
HAZARD CLASSIFICATION: HIGH (FIELD OBSERVATION)
REQUIRED SDF: $\frac{1}{2}$ PMF TO PMF (REF 1, TABLE 3)

HYDROGRAPH PARAMETERS

- LENGTH OF LONGEST WATERCOURSE FROM RESERVOIR

INLET TO BASIN DIVIDE: $L' = 0.5$ MILES

(USGS TOPO QUAD - SWEET VALLEY, PA)

$C_p = 0.50$
 $C_e = 1.85$

(SUPPLIED BY COE; ZONE 13, NORTH
BRANCH SUSQUEHANNA RIVER BASIN)

SUBJECT DAM SAFETY INSPECTION

HARRIS POND DAM

BY DJS DATE 2-5-81 PROJ. NO. 80-238-569

CHKD BY DJA DATE 3-4-81 SHEET NO. 3 OF 11

CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental Specialists

$$\begin{aligned}\text{Snyder's Standard Lag: } t_p &= C_t (L')^{0.6} \\ &= 1.85 (0.5)^{0.6} \\ &= \underline{1.22 \text{ HOURS}}\end{aligned}$$

NOTE SINCE THE BASIN CENTROID IS LOCATED WITHIN THE RESERVOIR (SEE FIGURE 1), THE SNYDER STANDARD LAG IS ESTIMATED AS $t_p = C_t (L')^{0.6}$ HOURS (AS PER C.O.E.). HYDROGRAPH VARIABLES AND MORE ARE DEFINED IN REF 2, IN SECTION ENTITLED "SNYDER SYNTHETIC UNIT HYDROGRAPH."

RESERVOIR STORAGE CAPACITY

RESERVOIR SURFACE AREAS:

SURFACE AREA (SA) @ NORMAL POOL (EL 1279.0) = 39 ACRES

SA @ EL 1280 = 45 ACRES

SA @ EL 1300 = 70 ACRES

(PLANIMETERED ON USGS TOPO QUAD - SWEET VALLEY, PA)

S.A @ TOP OF DAM (EL. 1280.9) = 46.1 ACRES

(BY LINEAR INTERPOLATION)

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
BY WJS DATE 2-9-81 PROJ. NO. 80-238-569
CHKD. BY DLS DATE 3-4-81 SHEET NO. 4 OF 11



"ZERO-STORAGE ELEVATION":

BY USE OF THE CONIC METHOD,

$$\text{VOLUME AT NORMAL POOL} = \frac{1}{3} H A, \quad (\text{REF. 10})$$

WHERE H = MAXIMUM DEPTH OF RESERVOIR, IN FT,

AND A = SURFACE AREA @ NORMAL POOL = 39 ACRES.

$$153 \text{ AC-FT} = \left(\frac{1}{3}\right) H (39)$$

$$H = \underline{11.8 \text{ FT}}$$

$$\therefore \text{ZERO STORAGE ASSUMED AT } 1279.0 - 11.8 = \underline{1267.2}$$

NOTE: ALTHOUGH THE MINIMUM RESERVOIR ELEVATION PROBABLY OCCURS AT SOME ELEVATION ABOVE 1267.2, THIS VALUE MUST BE USED IN THE HEC-1 INPUT IN ORDER TO MAINTAIN A STORAGE OF 153 ACRE-Feet AT NORMAL POOL.

ELEVATION-STORAGE RELATIONSHIP:

THE ELEVATION-STORAGE RELATIONSHIP IS COMPUTED INTERNALLY IN THE HEC-1 PROGRAM, BY USE OF THE CONIC METHOD, BASED ON THE ELEVATION-SURFACE AREA DATA GIVEN ABOVE. (SEE SUMMARY INPUT/OUTPUT SHEETS).

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
 DESIGNED BY DJS DATE 2-9-81 PROJ. NO. 80-238-569
 CHECKED BY DLA DATE 3-4-81 SHEET NO. 5 OF 11



PMP CALCULATIONS

FROM REF 9, FIG. 2, OBTAIN PMP VALUE FOR A BASIN OF DRAINAGE AREA 300 SQUARE MILES, FOR A DURATION OF 24 HOURS:

PRECIP = 22.2 INCHES

- FROM REF. 9, FIG. 1, THE GEOGRAPHIC ADJUSTMENT FACTOR = 98%

- AREA CORRECTION FACTOR (REF. 9):

DURATION (HRS):	6	12	24	48	72
FACTOR (%):	117.5	127.0	136.0	142.5	145.0

- TOTAL CORRECTION FACTOR ($0.98 \times$ AREA CORRECTION FACTOR):

DURATION (HRS):	6	12	24	48	72
FACTOR (%):	115	124	133	140	142

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AND FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALL BASIN) FOR A DRAINAGE AREA OF 0.5 SQUARE MILES IS 0.80.

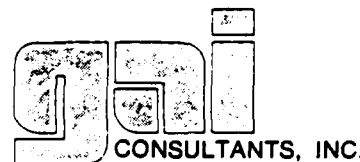
(REF 4, p 48)

SUBJECT DAM SAFETY INSPECTION

HARRIS POND DAM

BY DJS DATE 2-12-81 PROJ. NO. 80-238-569

CHKD. BY DLB DATE 3-4-81 SHEET NO. 6 OF 11

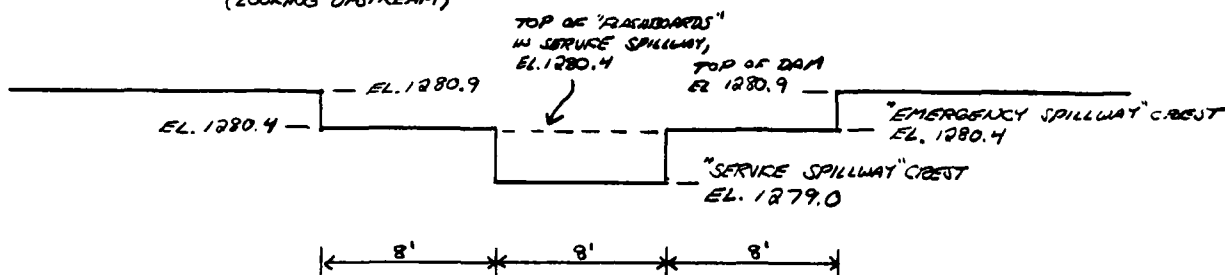


Engineers • Geologists • Planners
Environmental Specialists

SPILLWAY CAPACITY

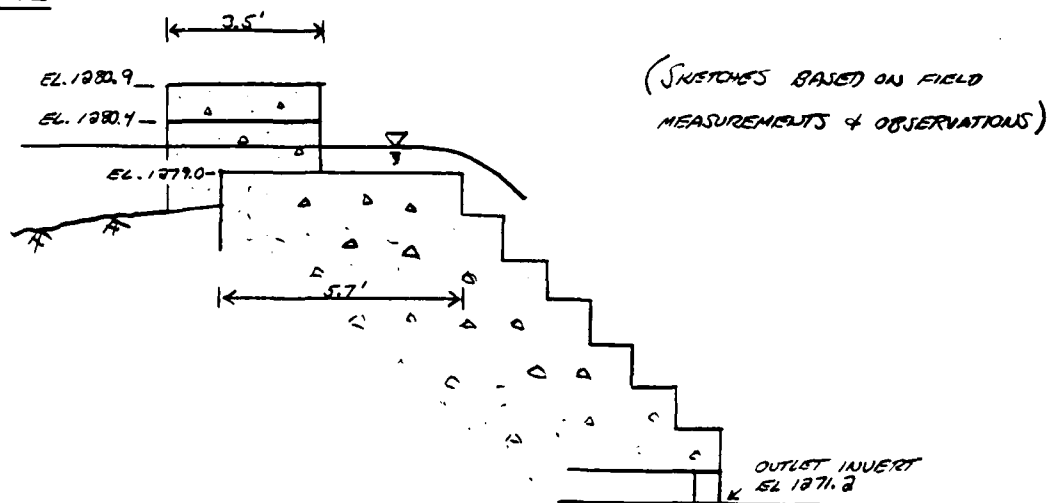
CROSS-SECTION :

(LOOKING UPSTREAM)



(NOT TO SCALE)

PROFILE :



(NOT TO SCALE)

THE SPILLWAY CONSISTS OF A CONCRETE GRAVITY TYPE STRUCTURE, WITH A TWO-STAGE BROAD CRESTED WEIR AND A STEP-LIKE DOWNSTREAM FACE, AS SKETCHED ABOVE. IN THE ANALYSIS, THE "FLASHBOARDS" IN THE SERVICE SPILLWAY WERE ASSUMED TO BE REMOVED.

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
 BY DJS DATE 2-12-81 PROJ. NO. 80-238-569
 CHKD. BY DLB DATE 3-4-81 SHEET NO. 7 OF 11



DISCHARGE OVER THE WEIR CAN BE ESTIMATED BY THE EQUATION

$$Q = CLH^{3/2} \quad (\text{REF 5, p. 5-23})$$

WHERE Q = DISCHARGE OVER THE WEIR, IN CFS,
 C = COEFFICIENT OF DISCHARGE,
 L = LENGTH OF WEIR, IN FT.,
 H = HEAD, IN FT.

THE DISCHARGE COEFFICIENT FOR EACH PORTION OF THE WEIR IS ASSUMED TO BE ON THE ORDER OF 2.7, BASED ON REF 5, TABLE 5-3. THE WEIR LENGTH AT ELEVATION 1279.0 IS 8.0 FT, AND AT ELEVATION 1280.4 IS 16.0 FT.

SPILLWAY RATING TABLE:

	RESERVOIR ELEVATION (FT)	"SERVICE SPILLWAY" LEVEL		"EMERGENCY SPILLWAY" LEVEL		$Q_{\text{TOTAL}}^{\text{③}}$ (CFS)
		H_s (FT)	$Q_s^{\text{①}}$ (CFS)	H_e (FT)	$Q_e^{\text{②}}$ (CFS)	
("SERVICE SPILLWAY CREST")	1279.0		0	—	—	0
	1280.0	1.0	22	—	—	20
("EMERGENCY SPILLWAY CREST")	1280.4	1.4	36	0	0	40
(TOP OF DAM)	1280.9	1.9	57	0.5	15	70
	1281.2	2.2	70	0.8	31	100
	1281.5	2.5	85	1.1	50	140
	1282.0	3.0	112	1.6	87	200
	1283.0	4.0	173	2.6	181	350
	1284.0	5.0	241	3.6	295	540
	1285.0	6.0	317	4.6	426	740
	1286.0	7.0	400	5.6	572	970

① $Q_s = (2.7)(8)H_s^{3/2}$

② $Q_e = (2.7)(16)H_e^{3/2}$

③ $Q_{\text{TOTAL}} = Q_s + Q_e$ (TO NEAREST 10 CFS)

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
 BY DJS DATE 2-17-81 PROJ. NO. 80-238-569
 CHKD. BY DLB DATE 3-4-81 SHEET NO. 8 OF 11



EMBANKMENT RATING CURVE

ASSUME THAT CRITICAL FLOW OCCURS ON THE "EMBANKMENT" CREST (SEE SHEETS 9, 10), AND THAT THE DISCHARGE OVER THE "EMBANKMENT" CAN BE ESTIMATED BY THE RELATIONSHIP

$$Q = 3.087 L H^{3/2} \quad (\text{REF. 5, P. 5-24})$$

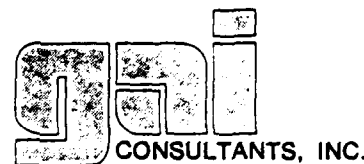
WHERE L = LENGTH OF EMBANKMENT INUNDATED, IN FT,
 H = HEAD, IN FT; IN THIS CASE IT IS THE AVERAGE
 "FLOW AREA WEIGHTED" HEAD ABOVE THE CREST.

LENGTH OF EMBANKMENT INUNDATED VS RESERVOIR ELEVATION:

<u>ELEVATION</u> <u>(FT)</u>	<u>LENGTH</u> <u>(FT)</u>
1280.90	0
1280.91	60
1281.0	85
1281.1	115
1281.4	140
1282.0	160
1282.5	175
1283.0	185
1283.5	200
1284.0	220
1285.0	255
1286.0	285

(FROM FIELD SURVEY AND USGS
 TOPO QUAD - SUGAR VALLEY, PA)

ASSUME THAT INCREMENTAL DISCHARGES OVER THE EMBANKMENT FOR SUCCESSIVE RESERVOIR ELEVATIONS ARE APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTIONAL FLOW AREA. THEN ANY INCREMENTAL AREA OF FLOW CAN BE ESTIMATED AS $A_i [(L_1 + L_2)/2]$, WHERE L_1 = LENGTH OF OVERTOPPED

SUBJECT DAM SAFETY INSPECTIONHARRIS POND DAMBY DJS DATE 2-18-81 PROJ. NO. 80-238-569CHKD. BY DLO DATE 3-4-81 SHEET NO. 9 OF 11Engineers • Geologists • Planners
Environmental Specialists

EMBANKMENT AT HIGHER ELEVATION, L_2 = LENGTH AT LOWER ELEVATION, H_i = DIFFERENCE IN ELEVATIONS. THUS, THE TOTAL AVERAGE "FLOW AREA WEIGHTED" HEAD CAN BE ESTIMATED AS $H_w = (\text{TOTAL FLOW AREA} / L_1)$.

EMBANKMENT RATING TABLE:

RESERVOIR ELEVATION (FT)	L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	INCREMENTAL FLOW AREA, A_i (FT ²)	TOTAL FLOW AREA, A_T (FT ²)	WEIGHTED HEAD, H_w (FT)	Q (CFS)
1280.90	0	—	—	—	—	—	—
1280.91	60	0	0.01	—	—	—	—
1281.0	85	60	0.1	7	7	0.0	10
1281.1	115	85	0.1	10	17	0.15	20
1281.4	140	115	0.3	38	55	0.39	110
1282.0	160	140	0.6	90	145	0.91	430
1282.5	175	160	0.5	84	229	1.3	800
1283.0	185	175	0.5	90	319	1.7	1270
1283.5	200	185	0.5	96	415	2.1	1880
1284.0	220	200	0.5	105	520	2.4	2530
1285.0	255	220	1.0	238	758	3.0	4090
1286.0	285	255	1.0	270	1028	3.6	6010

① $A_i = H_i [(L_1 + L_2) / 2]$

② $H_w = A_T / L_1$

③ $Q = 3.087 L_1 H_w^{3/2}$ (ROUNDED TO NEAREST 10 CFS)

CHECK FOR CRITICAL FLOW CONTROL:

$$S_c = \left[\frac{nQ}{1.49 A_c R_c^{4/3}} \right]^2 \quad (\text{REF 13, p. 143})$$

WHERE S_c = CRITICAL SLOPE, A_c = FLOW AREA AT CRITICAL DEPTH, IN FT², R_c = HYDRAULIC RADIUS AT CRITICAL DEPTH, IN FT n = MANNING'S ROUGHNESS COEFFICIENT = 0.035 (GRASS COVER, REF 7, p. 113).

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
BY DJS DATE 2-18-81 PROJ. NO. 80-238-569
CHKD. BY DLB DATE 3-4-81 SHEET NO. 10 OF 11



ALSO, $D_c = \frac{2}{3} H$ (REF 13, p.143)

WHERE D_c = CRITICAL DEPTH, IN FT
 H = HEAD, IN FT.

- AT RESERVOIR ELEVATION 1286.0,

$$D_c = \frac{2}{3} H_w = \frac{2}{3} (3.6) = 2.4 \text{ FT}$$

$\therefore A_c = 520 \text{ FT}^2$ (FROM TABLE, SHEET 9)
AND $R_c = D_c = 2.4 \text{ FT}$ (WIDE SHALLOW CHANNEL)

$$S_c = \left[\frac{(0.035)(6010)}{(1.49)(520)(2.4)^{2/3}} \right]^2 = 0.023 \text{ FT/FT}$$

HOWEVER, FROM FIELD MEASUREMENTS, $S_{\text{ACTUAL}} = 0.056 \text{ FT/FT}$.

SINCE THE ACTUAL SLOPE OF THE DOWNSTREAM PORTION OF THE "EMBANKMENT" IS GREATER THAN THE CRITICAL SLOPE, IT IS CONCLUDED THAT CRITICAL FLOW DOES CONTROL (SEE SHEET 8).

SUBJECT DAM SAFETY INSPECTION

HARRIS POND DAM

BY DJS DATE 2-18-81 PROJ. NO. 80-238-569

CHKD. BY DLB DATE 3-4-81 SHEET NO. 11 OF 11



CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental Specialists

TOTAL FACILITY RATING TABLE

$$Q_{TOTAL} = Q_{SPILLWAY} + Q_{EMBANKMENT}$$

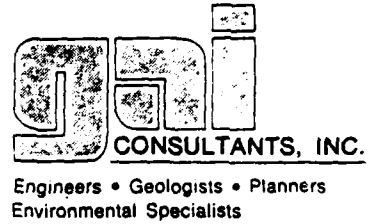
RESERVOIR ELEVATION (FT)	Q ^① SPILLWAY (CFS)	Q ^② EMBANKMENT (CFS)	Q _{TOTAL} (CFS)
1279.0	0	—	0
1280.0	20	—	20
1280.4	40	—	40
(TOP OF DAM) 1280.9	70	0	70
1281.0	80 *	10	90
1281.1	90 *	20	110
1281.4	130 *	110	240
1282.0	200	430	630
1282.5	280 *	800	1080
1283.0	350	1270	1620
1283.5	450 *	1880	2330
1284.0	540	2530	3070
1285.0	740	4090	4830
1286.0	970	6010	6980

* - BY LINEAR INTERPOLATION, FROM SHEET 7 (TO NEAREST 10 CFS).

① FROM SHEET 7

② FROM SHEET 9

SUBJECT DAM SAFETY INSPECTION
HARRIS POND DAM
 BY RJS DATE 3-4-81 PROJ. NO. 80-238-569
 CHKD. BY DLB DATE 3-4-81 SHEET NO. A OF C



SUMMARY INPUT/OUTPUT SHEETS

OVERTOPPING ANALYSIS

DAM SAFETY INSPECTION
 HARRIS POND DAM 0000 OVERTOPPING ANALYSIS 0000
 15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

JOB SPECIFICATION									
NO	NHR	DMIN	IDAY	1HR	IMIN	METHC	IPLT	IPRT	INSTAM
208	0	15	0	0	0	0	0	0	0
JUPER				MWT	LRUPT	TRACE			
5				0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRTIUE 3 LRTIUE 1

NFIUSE= .10 .50 1.00

SUB-AREA RUNOFF COMPUTATION

RESERVOIR INFLOW HYDROGRAPHS

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISAME	ISUM	LOCAL
1	0	0	0	0	0	1	1	0	0

HYDROGRAPH DATA

INTEG	TIME	TARPA	SWAP	TRSPD	RATIO	ISUM	ISAME	LOCAL
1	1	.50	0.00	.50	0.000	0	1	0

PRECIP DATA
 SPFE PMS R6 R12 R24 M48 R72 M96
 0.00 22.20 115.00 124.00 133.00 140.00 142.00 0.00

INITIAL & CONSTANT RAINFALL
 LOSSES AS PER C.O.E.

LRUPT	STNR	DLTKR	RTIOL	CRAIN	STRAS	RTIOL	STRIL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
 TP= 1.22 CP= .50 NTA= 0 BASE FLOW PARAMETERS
 AS PER C.O.E.

RECESSION DATA
 STRIDE -1.50 ORCSME -.05 NFIUSE= 1.00

APPROXIMATE CLANK COEFFICIENTS FROM GIVEN STORM CP AND TP ARE TCE= 5.35 AND RE= 0.49 INTERVALS

UNIT HYDROGRAPH 38 EED-UP-PERIOD ORDINATES, IAGE 1.23 HOURS, CP= .50 VOL= 1.00									
11.	39.	77.	112.	132.	129.	113.	97.	83.	71.
01.	52.	45.	38.	31.	28.	24.	21.	18.	15.
11.	11.	10.	6.	7.	6.	5.	4.	4.	3.
3.	2.	2.	2.	2.	1.	1.	1.	1.	1.

MAIN FACS LOSS COMP C

SUM 25.22 22.61 2.01 24625.
 (641.3) (574.1) (66.1) (810.89)

DAM SAFETY INSPECTION

HARRIS POND DAM

255

DATE _____

PROJ. NO.

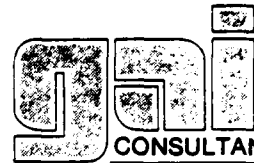
80-238-569

DLA

DATE _____

SHEET NO.

B OF C



CONSULTANTS, INC.

**Engineers • Geologists • Planners
Environmental Specialists**

HYDROGRAPHS

C.10PMF

0.50 PMF

PMF

	CF3	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
	1472.	471.	921.	301.	103.		2963.9.
CMB			26.	9.	3.		339.
INCHES			17.14	22.39	22.97		22.97
MM			435.44	568.63	583.49		583.49
AC-FT			597.	597.	612.		612.
MINUS CM H			564.	136.	755.		755.

HYDROGRAPH MOUNTING

ROUTE THROUGH KFSH.VOYN

ISTAG	ICOMP	IECON	ITAPP	JPLT	JPRI	INAME	ISTAGE	IAUTU
---	---	---	---	0	0	---	0	---
101	1	0	0	0	0	1	0	---

ROUTING DATA									
CLASS	CLASS	AVG	INSE	ISAME	JOPT	IPMP	LSWK	STNA	ISPRAT
0.0	0.000	0.00	0	1	0	0	0	1279	1

STAGE	1279.00	1240.00	1280.40	1260.90	1281.00	1281.10	1281.40	1282.00	1282.50
	1283.50	1284.00	1285.00	1286.00					
FIRM	0.00	20.00	40.00	70.00	90.00	110.00	240.00	630.00	1080.00

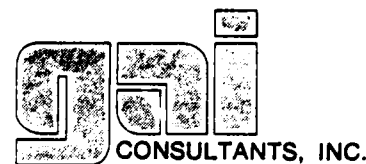
SURFACE AREA	0.	39.	45.	46.	70.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
--------------	----	-----	-----	-----	-----	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUBJECT DAM SAFETY INSPECTION

HARRIS POND DAM

BY DJS DATE 3-4-81 PROJ. NO. 80-238-569

CHKD. BY DLB DATE 3-4-81 SHEET NO. C OF C



RESERVOIR OUTFLOW HYDROGRAPHS

0.10PMF

0.50PMF

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	25.	23.	18.	7.	2097.
CMS	1.	1.	0.	0.	59.
INCHES		.43	1.31	1.63	
MM		10.92	33.29	41.30	41.30
AC-FT		11.	35.	43.	43.
THOUS CU M		14.	43.	53.	53.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	558.	364.	129.	46.	13309.
CMS	16.	10.	4.	1.	377.
INCHES		6.76	9.60	10.32	10.32
MM		171.81	243.79	262.06	262.06
AC-FT		180.	256.	275.	275.
THOUS CU M		222.	316.	339.	339.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1306.	857.	278.	97.	27948.
CMS	37.	24.	8.	3.	791.
INCHES		15.95	20.69	21.67	21.67
MM		405.18	525.46	550.29	550.29
AC-FT		425.	551.	577.	577.
THOUS CU M		534.	680.	712.	712.

SUMMARY OF DAM SAFETY ANALYSIS

	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	DURATION	TIME OF	TIME OF
	STORAGE	1279.00	1279.00	1280.90	OVER TOP	OUTFLOW	FAILURE
	OUTFLOW	153.	153.	236.	HOURS	HOURS	HOURS
		0.	0.	70.			
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	MAXIMUM			
OF	RESERVOIR	STORAGE	OUTFLOW	OUTFLOW			
PMF	DEPTH	AC-FT	CFS	CFS			
.10	1280.09	200.	25.	0.00	45.25	0.00	0.00
.50	1281.89	283.	558.	9.00	42.25	0.00	0.00
1.00	1282.71	322.	1306.	12.50	41.50	0.00	0.00

(OVERTOPPING OCCURS @ ±0.13PMF.)

LIST OF REFERENCES

1. "Recommended Guidelines for Safety Inspection of Dams," prepared by Department of the Army, Office of the Chief of Engineers, Washington, D. C. (Appendix D).
2. "Unit Hydrograph Concepts and Calculations," by the U. S. Army, Corps of Engineers, Baltimore District (L-519).
3. "Seasonal Variation of Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours," Hydrometeorological Report No. 33, prepared by J. T. Reidel, J. F. Appleby and R. W. Schloemer, Hydrologic Service Division, Hydrometeorological Section, U. S. Army, Corps of Engineers, Washington, D. C., April 1956.
4. Design of Small Dams, U. S. Department of the Interior, Bureau of Reclamation, Washington, D. C., 1973.
5. Handbook of Hydraulics, H. W. King, and E. F. Brater, McGraw-Hill, Inc., New York, 1963.
6. Standard Handbook for Civil Engineers, F. S. Merritt, McGraw-Hill, Inc., New York, 1963.
7. Open-Channel Hydraulics, V. T. Chow, McGraw-Hill, Inc., New York, 1959.
8. Weir Experiments, Coefficients, and Formulas, R. E. Horton, Water Supply and Irrigation Paper No. 200, Department of the Interior, United States Geological Survey, Washington, D. C., 1907.
9. "Probable Maximum Precipitation, Susquehanna River Drainage Above Harrisburg, Pennsylvania," Hydrometeorological Report No. 40, prepared by H. V. Goodyear and J. T. Riedel, Hydrometeorological Branch Office of Hydrology, U. S. Weather Bureau, U. S. Department of Commerce, Washington, D. C., May, 1965.
10. Flood Hydrograph Package (HEC-1) Dam Safety Version, Hydrologic Engineering Center, U. S. Army, Corps of Engineers, Davis, California, July 1978.
11. "Simulation of Flow Through Broad Crest Navigation Dams with Radial Gates," R. W. Schmitt, U. S. Army, Corps of Engineers, Pittsburgh District.
12. "Hydraulics of Bridge Waterways," BPR, 1970, Discharge Coefficient Based on Criteria for Embankment Shaped Weirs, Figure 24, page 46.

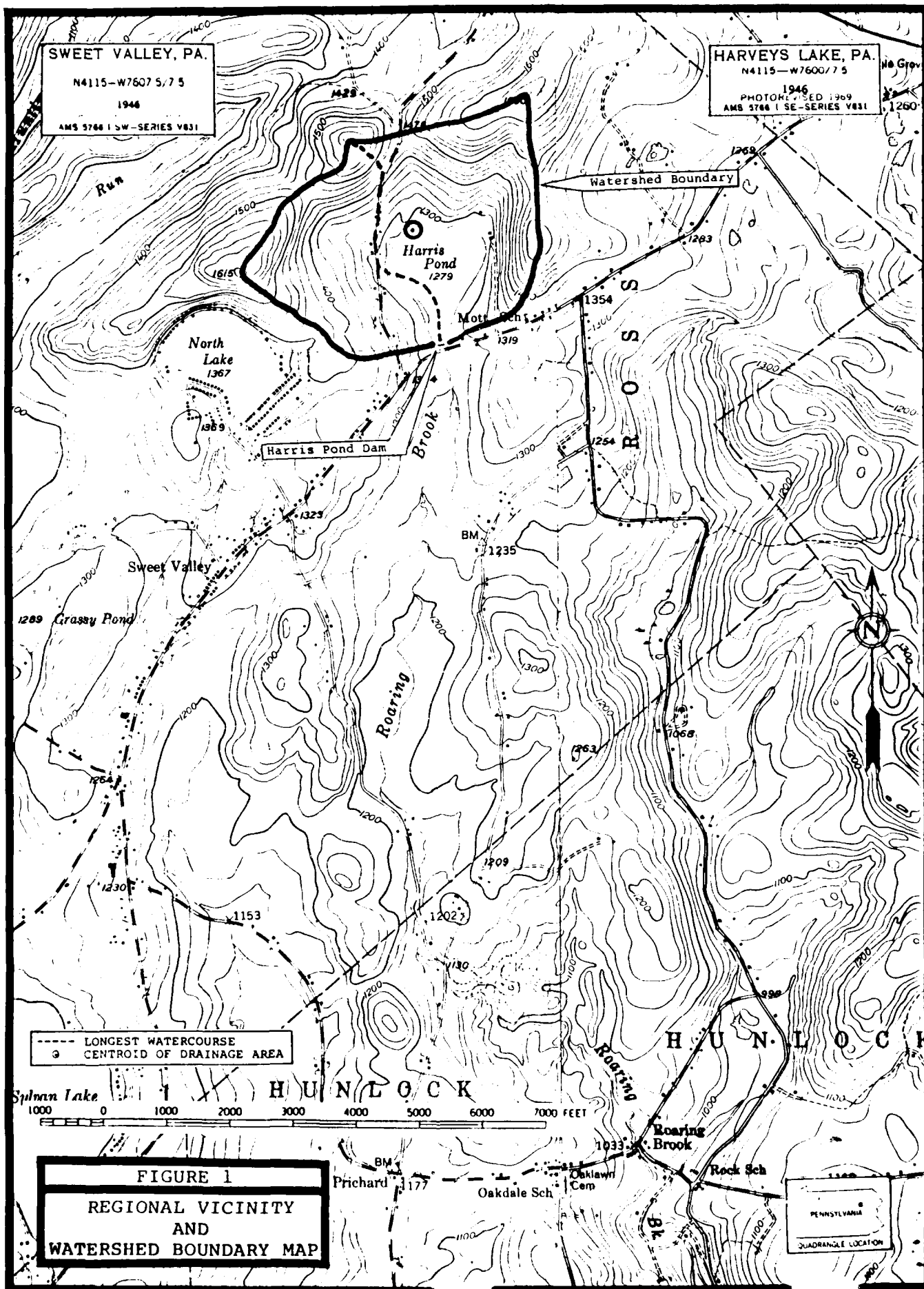
13. Applied Hydraulics in Engineering, H. M. Morris and J. N. Wiggert, Virginia Polytechnic Institute and State University, 2nd Edition, The Ronald Press Company, New York, 1972.
14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.
15. Engineering Field Manual, U. S. Department of Agriculture, Soil Conservation Service, 2nd Edition, Washington, D. C., 1969.
16. Water Resources Engineering, R. K. Linsley and J. B. Franzini, McGraw-Hill, Inc., New York, 1972.
17. Engineering for Dams, Volume 2, W. P. Creager, J. D. Justin, J. Hinds, John Wiley & Sons, Inc., New York, 1964.
18. Roughness Characteristics of Natural Channels, H. H. Barnes, Jr., Geological Survey Water-Supply Paper 1849, Department of the Interior, United States Geological Survey, Arlington, Virginia, 1967.
19. "Hydraulic Charts for the Selection of Highway Culverts," Hydraulic Engineering Circular No. 5, Bureau of Public Roads, Washington, D. C., 1965.

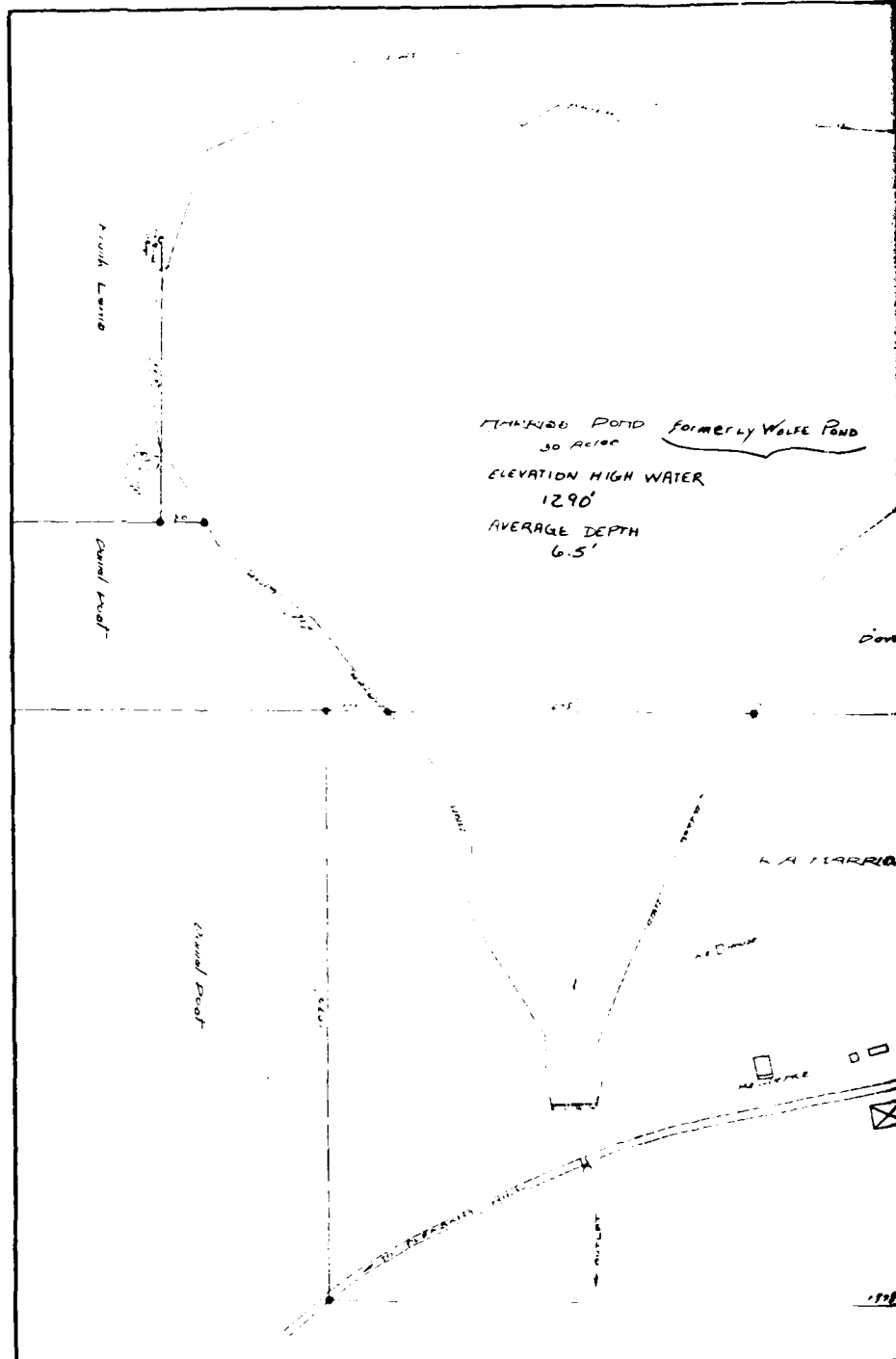
APPENDIX E

FIGURES

LIST OF FIGURES

<u>Figure</u>	<u>Description/Title</u>
1	Regional Vicinity and Watershed Boundary Map
2	Site Plan
3	Embankment Plan and Section





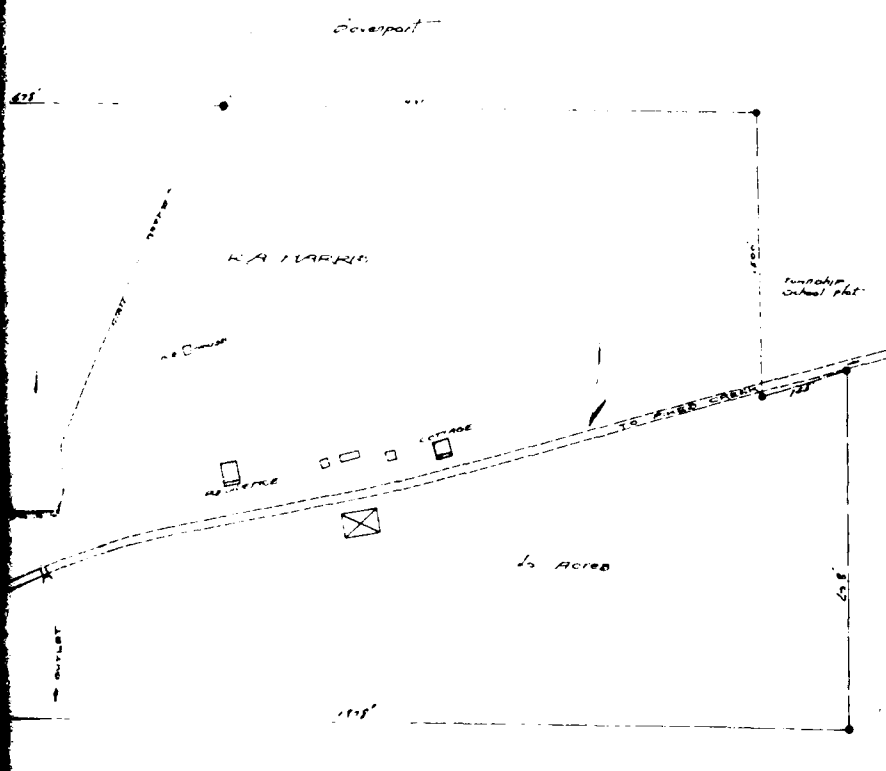
MAP
OF THE
RA HARRIS FARM AND
POND
IN ROSS TOWNSHIP
LUZERNE COUNTY PENNA

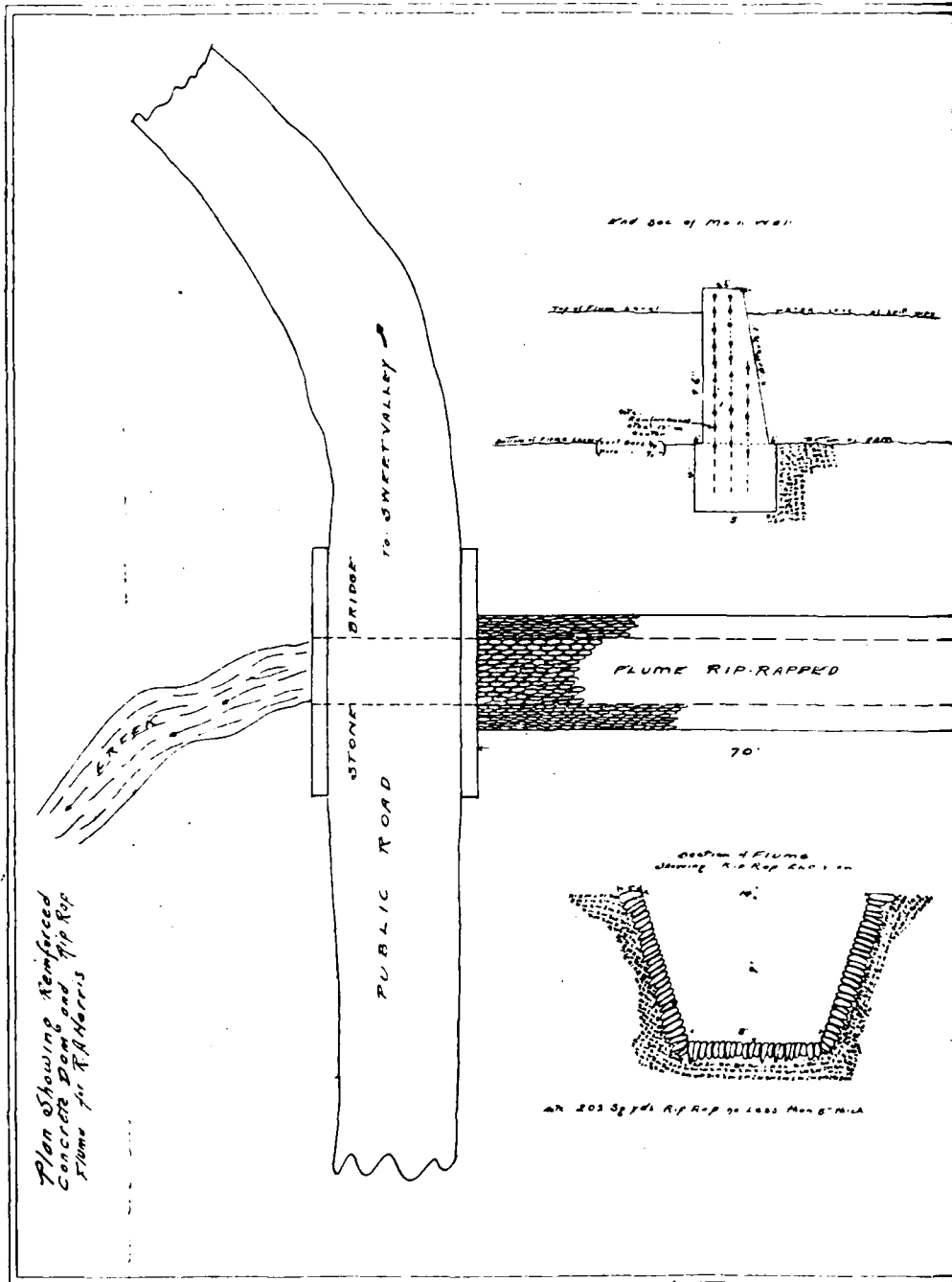
SCALE 1"=100 FT

This J. Henderson, Esq.
Wilkes-Barre, Pa



100 POND FORMERLY WOLFE POND
100 ACRES
TIDE HIGH WATER
2290'
POND DEPTH
6.5'





APPENDIX F

GEOLOGY

Geology

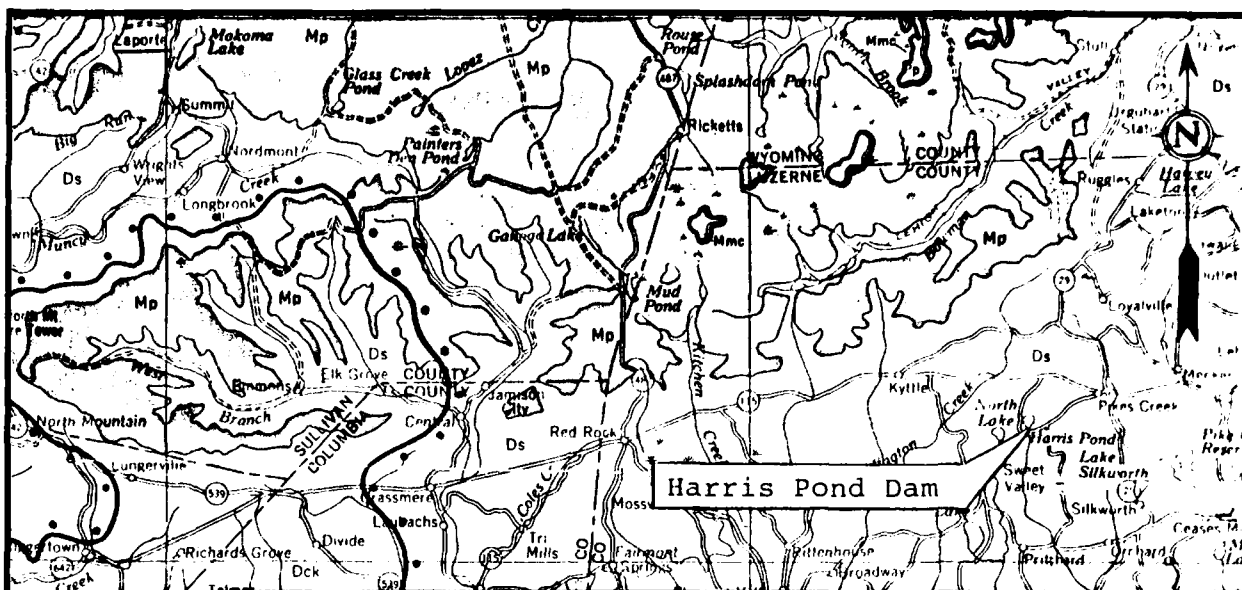
Harris Pond Dam is located in Luzerne County, just west of the Allegheny Front, in the glaciated portion of the Allegheny High Plateaus section of the Appalachian Plateaus physiographic province. In this area, the Allegheny High Plateaus section is characterized by nearly horizontal rock strata, predominately of Devonian age, forming a mature, glaciated high plateau of moderate relief. The geomorphic evidence indicates the region was base leveled, reduced to a well defined peneplain, elevated and, eventually covered by the Wisconsin continental ice sheet. Subsequent stream erosion has resulted in the present hilly topography. The Allegheny Front, separating the Appalachian Plateaus physiographic province from the Valley and Ridge physiographic province is readily definable, as the dip of the rock strata changes from approximately 0° - 5° to 30° - 60° , respectively.

The advance of continental ice during Wisconsin time ended at the Wisconsin terminal moraine which crosses the southern part of Luzerne County. North of the terminal moraine the greater part of the county is covered by a blanket of glacial drift of variable thickness. Generally, more extensive deposits of glacial outwash occur along the Susquehanna River valley; whereas, lesser deposits occur along the smaller tributary valleys.

The much older near surface sedimentary rock sequence underlying the glacial deposits in the area of the dam site are probably of the Susquehanna Group of Upper Devonian age. The Catskill Formation of the Susquehanna Group is characteristically composed of shale, claystone, siltstone, sandstone, and conglomerate. This sedimentological change observed in the Catskill Formation probably represents a major basin infilling event, during which the rate of sedimentation exceeded the rate of basin subsidence, resulting in a facies change from marine to non-marine strata.

References

1. Lohman, S. W., Ground Water in Northwestern Pennsylvania, Pennsylvania Geological Survey, Fourth Series, Bulletin W4, 1937.



LEGEND

PENNSYLVANIAN



Pottsville Group

Light gray to white, coarse grained sandstones and conglomerates with some mineable coal. Includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.



MISSISSIPPIAN

Mauch Chunk Formation

Red shales with brown to greenish gray flaggy sandstones. Includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties; Logansport Limestone at the base in southwestern Pennsylvania.



Pocono Group

Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale. Includes the Appalachian Plateau, Burgoon, Shenango, Cayahoga, Cussewago, Carry, and Kapp formations. Includes part of Onondaga at M. L. Fuller in Potter and Tioga counties.

DEVONIAN



Susquehanna Group

Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey. County reports, barbs on "Chemung" side of line.

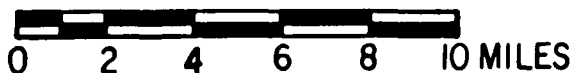


Catskill Formation

Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

--- Border of Wisconsin drift

Scale



GEOLOGY MAP

REFERENCE

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA. DEPT. OF INTERNAL AFFAIRS, DATED 1960, SCALE 1" = 4 MILES

gai
CONSULTANTS, INC.

ATE
LMED
-8